Deploying e-Health Solutions in Latin America and the Caribbean: Development and Policy Issues

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1. Introduction

e-Health, the combined utilization by the health sector of information and communication technologies (ICT) and networked data processing to transmit, store, and retrieve digital data for clinical, educational, and administrative purposes, both at the local site and at distance, is growing at a rapid pace [1, 2, 3]. Among leading digital technologies, Internet-based ICT solutions are rapidly changing the way health organizations, providers, care plans, payers, regulators, and consumers, access information, acquire health products and services, deliver care, and communicate with each other [4, 5].

e-Health has attempted to replicate e-Commerce and e-Government strategies and experiences in using Internet-based networked technologies to rethink, redesign, and rework how businesses and public services operate by productivity improvement and better effectiveness and efficiency in the exchanges with clients, customers, suppliers, and partners. In developed countries, e-Health has evolved from the delivery of online medical content toward the adaptation of generic e-Commerce solutions to the processing of administrative transactions, logistical support of clinical tasks, and the operational support of decentralized and collaborative healthcare. Emerging e-Health applications are oriented to professional networking, integration of the clinical care process management, and the provision of Web-based health information and patient care, including remote monitoring and healthcare. This expanded view of e-Health has been promoted as the final stage in bringing the entire healthcare industry online.

Heretofore designed for large organizations and industrialized countries, e-Health solutions are being increasingly proposed as an answer to the many management and operational problems and healthcare demands faced by health organizations in developing societies. There are, however, hard lessons to be learned from e-Commerce, e-Government, and e-Health achievements and failures in developed countries -- a careful examination of those experiences, *vis-à-vis* the characteristics of the health sector, organizational preparedness, and technological infrastructure of developing countries is a helpful exercise in the design of strategies and appropriate deployment of e-Health solution. Comprehensive assessments of those issues in Latin America and the Caribbean were recently published by the Pan American Health Organization [6, 7].

2. Health Sector Organization and Healthcare Delivery Issues

In every society, the health sector faces the predicament of providing expanded and equitable access to quality services in an environment of rising costs. The main cost and access drivers have been the shifting epidemiological profiles and changing demographics, particularly age structures and lifestyles; urbanization and industrialization; and the growing demand for better access to patient-oriented quality care. In addition, inefficient allocation of scarce resources and lack of coordination between health

subsectors, institutions, and other social agents and stakeholders with duplication of efforts, overlapping responsibilities, and resource wastage are widespread and troublesome problems.

In response, most countries are reorienting their health system and introducing substantive changes into the sector and in the relationships among stakeholders and the roles they play, with a view to increasing equity in benefits, efficiency in management, and effectiveness in satisfying the health needs and expectations of the population. Common responses that characterize most reform processes include: (a) the universalization of a high cost-benefit basic package of health services; (b) a set of standardized public health interventions; (c) cost containment and recovery; (d) administrative decentralization and operation of healthcare services; (e) recognition of the role of the private subsector and the intersectorality of health interventions; (f) health models oriented towards primary care and centered on people; (g) focus on quality and accountability; and (h) moving away from the reactive delivery of care to a more proactive and continuous management approach of the health status of individuals and population groups [8]. Service supply is a major component -- global demand for telehealth services is estimated to represent a potential market of US$ 1,25 trillion, of which about two-thirds is for direct services and the rest for second opinion, consumer information, continuing education, management and other services.

In this context, the business imperative for e-Health is concrete, is driven by the operational requirements of health reforms, and is aligned to many of the determinants found to be relevant to e-Commerce [9, 10]:

- Growth of a global marketplace and the ubiquity of interactive communications.
- Networks of producers, suppliers, customers, and clients.
- Leasing, membership, service agreement, and strategic alliance models replace traditional business organizations based on ownership of physical assets and long-term structures.
- Lifetime value of customer retention replacing “one time sell”.
- Economies of speed, forecasting demand, and customer service and satisfaction replacing economies of scale and impersonal service provision.
- Customization capable of achieving a “one of a kind” product or service.

3. Challenges to the Deployment of e-Health in Latin America and the Caribbean

3.1. Socioeconomic and Development Constraints

Technology distribution and access deficiencies represent the most acute issues in the dissemination of e-Health applications. In a more limited focus, the “digital divide” encapsulates the dramatic worldwide variation in access to computer-based information technologies, typically measured in terms of teleaccessibility, personal computer ownership, and Internet connectivity available to individuals and communities (Table 1). Digital divides, like social and economic divides, exist within and not just between societies and are integral parts of a much broader and intractable “development divide” that include insufficient telecommunications infrastructure, high telecommunications tariffs, inappropriate or weak policies, organizational inefficiency, lack of locally created content, and uneven ability to derive economic and social benefits from information-intensive activities [11].

The low level of capital investments in the health sector limits the market for new and expensive technologies. This is complicated by the fast-changing deployment of new technologies and accompanying standards that are constantly raising the level of advancement that must be met to remain current [12]. In the health sector, development and digital divides between industrialized and developing countries are wider than the gap observed in other productive and social sectors. In some cases, the

changes brought about by the privatization of healthcare did add to the already high degree of structural inequity that prevails in most of the low and middle-income countries.

Table 1. Teleaccessibility and Information Technology Distribution for the Year 2001
(Source: International Telecommunication Union, World Telecom Indicators 2002)

Countries	Main Telephone Lines per 100 Persons	Residential Main Lines per 100 Households	Monthly Subscription as % of Income per Capita	Personal Computers per 100 Persons	Internet Users per 10,000 Persons	Internet Hosts per 10,000 Persons
Low Income	2.9	11.4	14.1	0.6	62.2	1.0
Lower Middle Income	13.6	35.8	2.9	2.4	264.9	4.3
Upper Middle Income	22.7	59.8	2.0	8.2	992.6	78.7
High Income	59.7	108.8	0.7	37.3	3,992.9	1,484.2
WORLD	17.1	54.9	5.7	7.7	820.8	232.6
Africa	2.6	9.9	12.7	1.0	84.9	3.4
Americas	35.1	80.6	3.1	26.6	2,164.3	1,332.9
Asia	10.7	41.8	5.5	2.2	433.9	28.7
Europe	40.5	80.0	1.1	17.9	1,804.5	191.5
Oceania	40.0	98.3	3.7	39.9	2,771.6	885.2

3.2. Market Characteristics

Many market segments are becoming increasingly ICT-dependent as part of globalization [9]. However, unfounded vendor-driven expectations of how the Internet will revolutionize commerce and social services have too often overshot their target. The relative success observed in developed countries, particularly the U.S., in taking advantage of ICT may partly reflect their flexible and competitive markets. Possibly, smaller benefits can be expected in more regulated economies or in the case of implementation environments characterized by rigid labor, trade, and inefficient commodity markets and capital exchanges [13].

Web-enabling business in government operations is expensive. Required procedures involve changing procurement processes, integrating online and internal systems, buying applications, and paying transactions fees and intermediaries and it is generally very difficult for health executives, particularly in the public sector, to justify the levels of investment required. In many developing countries the market for health ICT products and services is limited. As an illustration, in Latin America and Caribbean the hospital subsector is characterized by small facilities – about 60 percent of the hospital facilities have 50 or fewer beds – that cannot afford major capital expenses in deploying ICT resources and would be hard-pressed to meet the operational costs to maintain in-house applications.

The straightforward transference of the e-Commerce experience and solutions to the health sector is also problematic because the healthcare environment has characteristics that are quite different from an “ideal” competitive market, guided by rational decisions and the balance of availability and demand for goods and services. Such differences include: social goals of the health sector (equity of access and quality of care); restricted number of producers (healthcare providers); self-interest is the main guiding force for providers and consumers (patients); provider makes most of the “buying” decisions (information asymmetry); many barriers to entry; monopoly supported by regulatory and legal instruments; branding is generalized (providers, pharmaceuticals); multiple uncontrolled externalities; and high risk and uncertainty or irreversibility of outcomes. Moreover, in the health sector there is low price elasticity for goods and services determined by scarce resource input, costly processes, and unequal distribution requiring allocation decisions; provider-induced supply and demand; monopolies and economies of scale are

difficult to circumvent; and constant conflict between managers and providers regarding efficiency issues, resource use, and cost control measures.

3.3. Cross-border Issues

Cross-border challenges are particularly pressing due to the growing number of national, international and non-governmental actors involved in transnational and global concerns. Areas of concern in the introduction of electronic marketplaces, particularly in developing countries, are related to the difficulties in regulating offshore business; the dominance of the Internet global communications infrastructure by a few countries; the growing concentration of power and knowledge in few corporations; and the economics of intellectual property and of technology acquisition and use. Market capture by strong, organized, and well-funded health provider organizations, some of international nature, is happening at a fast pace and regulatory methods have been advocated to safeguard local competition. Those highly specialized, closed, and regulated areas are being swiftly opened to new players in a marketplace that is still mostly unregulated and, at the same time, when novel and untried health reform models are being introduced.

Intellectual property has been a major area of concern and conflict. In the area of information technology the emphasis of intellectual rights has changed from the protection of the author/inventor to that of the investor. Implications for developing countries, welfare effects, foreign investments, transfer of technology, and impact on domestic markets are difficult to foresee particularly in relation to foreign direct investments and technology transfer [14]. Limiting acquisition of innovative technology only to those that are captured by the patent system ("inventions") makes a society permanently dependent of external sources. Even countries with significant high technology export have shown a negative balance of royalties and license fees representing a net transfer of resources to developed countries, particularly the U.S. (Table 2).

Table 2. Technology Exports, Royalties, and Licenses Payments for the Year 2000
(Source: World Bank, 2002 Development Indicators, modified)

Income Groups / Regions / Selected Countries	High Technology Exports as % of All Manufactured Products	Royalties and Licenses Income in Millions of US$	Royalties and Licenses Payments in Millions of US$	Royalties and Licenses Balance in Millions of US$
Low Income	7	105	1,108	- 1,003
Middle Income	16	1,768	9,956	- 8,188
Lower Middle Income	14	526	3,265	- 2,739
Upper Middle Income	17	1,242	6,691	- 5,449
Low and Middle Income	16	1,873	11,064	- 9,191
East Asia and Pacific	25	784	5,409	- 4,625
Europe and Central Asia	10	313	1,753	- 1,440
Latin America and Caribbean	16	501	2,666	- 2,165
Middle East and North Africa	1	106	614	- 508
South Asia	3	87	338	- 251
Sub-Saharan Africa	8	82	283	- 201
High Income	22	70,321	62,988	7,333
United States	34	38,030	16,100	21,930
Europe (European Union)	16	11,019	23,422	-12,403
Japan	28	10,227	11,007	-780
WORLD	29	72,194	74,051	- 1,857

3.4. Technology Infrastructure and Operational Issues

Besides achieving reliable transaction delivery, an e-Health architecture that is technologically successful must provide superior client service, customization of products and services, interactivity, and maximum convenience. An error to be avoided is to regard technology as the solution for logistical, administrative, and knowledge management problems of healthcare. Deployment and operation share infrastructure and operational issues that involve reliability of service, that directly depends on: (a) degree of information preparedness and information technology insertion in society; (b) an appropriate and functioning network and technology platforms and physical infrastructure; (c) the understanding of market relationships among the different actors in the informatics and telecommunications areas; (d) managing knowledge about health, individual client medical history, the environment, and enterprises; (e) data protection measures and regulatory framework to ensure transaction security; and (f) auditing processes that are quite diverse from traditional paper trail solutions. Dependable connectivity is needed for reliable transactions. In developing countries fast connectivity is still limited and usually only dialed-up access is available. Poor telecommunications infrastructure, limited number of Internet Service Providers (ISP), lack of access to international bandwidth, and affordable Internet access costs are readiness issues that continue to be major impediments to diffusion of Internet applications to the point of care in developing.

Per capita expenditure in ICT is a better indicator of the real level of investment than expenditure as percentage of the Gross Domestic Product. Some developing countries have expenditures that are comparable to that of developed countries when expressed as percentage of the GDP, although the absolute value per capita is low -- for instance, relative to GNP Brazil has the same level of expenditures as Canada, although in absolute value Brazil invests 6.6 times less than Canada in ICT (Table 3).

Table 3. Expenditures on Information and Communication Technologies in Selected Countries
(Source: World Bank, 2002 World Development Report)

Country	ICT Expenditures Per Capita in US$ (2000)	ICT Expenditures as % of GDP (2000)	Country	ICT Expenditures Per Capita in US$ (2000)	ICT Expenditures as % of GDP (2000)
Argentina	317	4.1	Hungary	431	8.7
Australia	1,992	9.7	Italy	1,068	5.7
Austria	1,697	7.2	Japan	3,118	8.3
Belgium	1,769	8.0	Mexico	189	3.2
Brazil	289	8.4	Norway	2,445	6.9
Canada	1,911	8.4	Russia	63	3.7
Chile	360	7.8	Singapore	2,104	9.7
China	46	5.4	Spain	731	5.1
Colombia	228	12.0	Sweden	2,674	10.4
Finland	1,835	7.8	United Kingdom	2,187	9.1
France	1,916	8.7	United States	2,296	8.1
Germany	1,798	7.9	Venezuela	196	3.9

The access site problem can be illustrated by the result of a 1999 survey of 42,744 physicians in Brazil. The study revealed that 52 percent used the Internet – a level of diffusion equivalent to the general U.S. population – however, when 23,603 physician users were asked from where they predominantly accessed the Internet, 85 percent indicated their home, 10 percent the office, and only 2 and 3 percent indicated the site as the university or the hospital respectively. In comparison, U.S. physicians have the

following Web access profile: 40 percent at the workplace, 56 percent at the office, 87 percent at home, and only 7 percent were not connected.

On a positive note, telecommunication sectoral reform is bringing significant improvement in services and drop in tariffs as a result of greater competition and expanding markets. With the recent rapid trade liberalization and modernization of the telecommunications sector in many countries of the developing world, the telecommunications infrastructure is improving. One-fourth of the eighty-nine major public telephone operators that were privatized throughout the world by the end of 1999 occurred in Latin America and the Caribbean [11].

3.5. Skilled and Committed Human Resources Are Essential

People are central in the value-added creation of e-Health products and services and an organization's human resource is the key to success. Employees' skills are the most expensive and least elastic resource and an obstacle to technological development in developing countries. The number of technicians, scientists, and portion of the GNP devoted to research and development is a good indicator of those capabilities (Table 4). The most successful efforts to incorporate information and communication technologies have occurred in countries with strong and efficient government and academic institutions committed to invest in education, scientific and technological development, and public services, in tandem with business sectors (for instance, banking and retail commerce) ready and willing to automate their operations.

Table 4. The Research and Educational Divide: Selected Technology Inputs by Region (1992-1997)
(Source: Rodríguez F and Wilson E, InfoDev World Bank 2000, modified)

Region	GNP per capita US$	R&D as % of GDP	Technicians per 10^6 Population	Scientists per 10^6 Population
OECD Countries	20,113	1.8	1,326.1	2,649.1
Eastern Europe & FSR	4,027	0.9	577.2	1,841.3
East Asia	6,270	0.8	235.8	1,026.0
Latin America & Caribbean	5,635	0.5	205.4	656.6
Middle East	8,941	0.4	177.8	521.0
Sub-Saharan Africa	1,971	0.2	76.1	324.3
South Asia	1,764	0.8	59.5	161.0

3.6. Public Health Authorities Frequently Have a Misguided Vision of ICT

Despite the fact that the health sector is key to the welfare of the population and the formation of human capital, the sector has not kept pace with the momentum of change that has been experienced in recent years in other areas of economic, political, and social life, even in developing countries. Most public health organizations in the developing world are not taking advantage of existing ICT opportunities and most existing information systems are inadequate to the requirements of the new models of healthcare being deployed in the context of health reform initiatives. Besides the common perception among physicians that health information systems are mostly a source for scientific and technical information, often public health authorities have a view of clinical-administrative information systems that is obsolete and frozen in a "statistical-epidemiological" archetype, designed for the collection of numerical data representing only counts of events and mostly generating only highly aggregated statistical data and time series related to mortality, morbidity, and to service utilization and coverage. Those information systems have very little practical interest to direct care professionals and unit managers and are far behind in providing the logistical and longitudinal individual client-based data required to operate and manage the sort of healthcare models being deployed in many countries [7].

Worse still, most public health authorities are totally oblivious to the broad variety of possibilities offered by modern information and communication technologies to manage client-based data, support operations, and mine large databases. Indeed, the health sector has not applied the range of options provided by information and telecommunication technologies as effectively as have other social sectors, and health has been conspicuously underrepresented in national technology development policies and plans.

3.7. Standardization is a Prerequisite

Great amount of work has been done in the creation and promotion of data-related standards and despite the lack of standards in some areas, fortunately there are solutions that allow different organizations and systems to communicate through standardized open access Internet software languages. Process and data standards for the healthcare industry involving all constituents – employers, consumers, providers, payers, and regulators – promoted by accrediting organizations have facilitated the adoption of common procedures and routines. A certain amount of standardization also has been driven by regulatory action. The experience of the U.S. with the introduction of the Health Insurance Portability and Accountability Act (HIPAA) regulations is of interest – it forced a reluctant health industry to adopt uniform formats for health data exchanges and uniform code sets to identify internal and external health services activities. An extensive review and reference source on healthcare data standards was published by the Pan American Health Organization [3].

3.8. Security and Privacy Are Major Concerns

Data security and privacy of personal health data are universal concerns and a high-priority issue in many countries. There is a growing concern regarding the protection of health records against intrusion, unauthorized use, data corruption, intentional or unintentional damage, theft, and fraud. Health data transmitted over national and international networks offer unprecedented opportunities for better patient care and community health interventions by facilitating data exchange among professionals but pose new challenges to confidentiality. The promise of Internet to improve care by timely access to the right information can only be realized through secure connections shared across all platforms.

Given the sensitive nature of healthcare information, and the high degree of dependence of health professionals on trustworthy records, the issues of reliability (data residing in the electronic health record are accurate and remains accurate), security (owner and users of the electronic health record can control data transmission and storage), and privacy (subject of data can control their use and dissemination) are of particular significance and must be clearly and effectively addressed by health and health-related organizations and professionals. A comprehensive review and reference source on personal data protection regulation was published by the Pan American Health Organization [15].

3.9. Quality of Publicly Available Information

This is probably one of the most serious issues in the area of Internet-based interactive health communications. The Internet offers unprecedented power to provide all users of healthcare information - patients, professionals, families, caregivers, educators, researchers, insurers, regulators, and policymakers - with data of unprecedented timeliness, accuracy, depth, and diversity. Yet it is equally clear that the very qualities that make the Internet such a rich marketplace of ideas – its decentralized structure, its global reach, its leveling of access to the tools of publication, its immediacy of response, and its ability to facilitate free-ranging interchange – also make the Web a channel for potential misinformation, concealed bias, covert self-dealing, and evasion of legitimate regulation. It is very difficult to ascertain and recommend on the credibility, motives, sponsorship, and eventual conflicts of interest in the more than 50,000 health websites in existence. Many health public-oriented websites are profit-driven, others promote unproven and even dangerous forms of treatment or products, while others may be good intentioned, but contain misleading or false information [16, 17, 18, 19, 20].

4. Recommendations on Policy, Strategies, and Organizational Changes in the Deployment of e-Health in Latin America and the Caribbean

To move ahead with the deployment and use of e-Health, coordinated actions must be conducted in the context of a framework that links public, private, and social efforts to speed the development and deployment of priority ICT solutions. Technical knowledge, experience, and financial investments needed to establish large and complex information system projects require tapping into resources and expertise that no single organization retains. Public and private institutions, academic organizations, the industry, and financing agents must find ways to pool their assets through project partnerships and add social value to applications of informatics by providing new employment opportunities, socioeconomic development, educational opportunities, promoting health, and supporting cost-effective health services.

The attainment of this mandate involves the participation of a large number of stakeholders, but the coordinating effort will necessarily concentrate on the public sector. Governments must grapple with the many transnational and global e-Health issues and address them in a comprehensive and collaborative manner. Notwithstanding, broad objectives are difficult to achieve and the best strategy is to start by identifying the most repetitive tasks associated to significant costs – e.g., the automation of claims and reimbursement procedures – and them proceed to other areas.

4.1. Developing a National Vision and Action Plan

The goal of a health ICT vision and strategic plan of action is to establish a coherent national arrangement to facilitate projects and infrastructure development, maximizing the benefits for invested financial resources, and enabling people to accept and function more effectively in an informatized environment. The immediate objective is to promote the deployment of core e-Health applications and support functions by incorporating an advanced informatics component into existing and new health programs and projects, supported by a combination of funding programs, incentive grant programs, and prototype development funding programs.

Implement rational policies for public and private payers addressed to the entire range of e-Health applications and technologies. Means should be developed for assessing the appropriateness of health services provided via telemedicine applications. Six priority areas are envisioned for government involvement in e-Health development and deployment: (a) promotion of education, training, and national planning capacity in information systems and technology; (b) convening groups for the implementation of standards; (c) sponsoring basic scientific and technological research and providing funding for prototype development; (d) ensuring the equitable distribution of resources, particularly to places and people considered by private enterprise to provide low opportunities for profit; (e) protecting rights of privacy, intellectual property, and security; and (f) overcoming the jurisdictional barriers to cooperation, particularly when there are conflicting regulations.

4.2. Strengthening Organizational and Human Resources: Awareness, Skills, and Leadership

Health organizations must be provided with information about the opportunities as well as the risks of e-Health solutions. Technology evaluation sources and results must be made available and health managers must be guided in the difficult process of systems specification, procurement, acquisition, and contracting ICT products and services. Knowledge repositories on ICT resources and solutions must be established in cooperation with the industry, centers for technology evaluation, academic research groups, and centers of excellence.

Human resources development through awareness programs, education of health staff, continuous training, and career opportunities must be institutionalized from the inception of the developmental effort. Transference of technical expertise and the appropriation of knowledge by health personnel are

necessary for the full participation of end-users in the development process and the best insurance for successful implementations. Success in the deployment of institutional e-Health applications depends on the existence of staff with the right mix of skills in all functions and levels.

4.3. Creating Incentives through Telecommunication Sector Reform

Changes in the telecommunication sector are essential to the establishment of health informatics and ensuring global competitiveness. Recommendations include actions in the following areas: market access issues (interconnection regulation framework, clear and transparent regulation governing competition, and allocation of spectrum harmonization); technical standards (interoperability standards and the streamlining and liberalization of conformity assessment process for equipment certification); regulation (elimination of rules of origin and treating products from different countries equally when standards are the same, the elimination of subsidies, antidumping practices, and abolishment of countervailing duties); promoting competition (establish a regulatory framework that balances national needs in the context of creating a competitive national telecommunications system, weigh cost of delaying competition against the need for an effective transitional regime, and move towards full liberalization as quickly as appropriate); protecting technology and intellectual property rights; and establishment of rational and affordable tariff structures.

4.4. Implementing Data-related Standards and a Regulatory and Legal Framework

Standards development and implementation must be carried out with the participation of the public and private sectors to achieve consensus on a set of principles for the collection, transfer, processing, storage, and use of health data over national and global information infrastructures. Providing technological interfaces that facilitate effective use of the infrastructure and its component systems involve systems capable of rendering information from multiple modalities, in conjunction with a variety of applications as aids to health services operational support and decision making. They will require modularity and connectivity compliant with standardized interface protocols.

Standards will be defined by a consortium of users, researchers, government, technical and scientific bodies, and the industry at three distinct levels: first, in terms of standardization of data and information; second, in terms of the computational facilities required to manipulate and store the information; and third, in terms of telecommunications facilities, employed to transfer information among dispersed sites.

Legal and regulatory infrastructure must be implemented with the goal of facilitating medical communication – at the professional level, such issues as interstate/province licensure and credentialing of service providers must be addressed, and legislation must be passed to ensure the protection of personal health information. To be effective and efficient, the healthcare industry must operate in a digital environment encompassing connectivity, commerce, and community/content sites. Using regulatory and legal power to nudge the health sector toward compliance is a valid and effective approach – the European and Canadian healthcare systems have used this strategy.

Developing countries can profitably learn from those experiences in the development of regulatory mechanisms that will provide the incentives to convince the health industry in deploying efficient and cost-effective e-Health applications that will move the healthcare system forward and result in real improvements in patient care and clinical practice. Legislation proposals should be initiated early in the process to ensure that the technology does not abridge patients' rights to confidentiality or security of medical records. Agreement on practice parameters must be developed to include aspects related to informed consent, physician liability, non-physician liability, reimbursement, practice parameters, and physician-patient relationships.

4.5. Financing and Public-Private Partnerships

Given the fact that the worldwide market for information technology, products, and services is currently valued at US$853 billion, and that worldwide investment in telecommunications infrastructure is expected to exceed US$200 billion by 2004, developing countries need to find ways to share this growing trend. Domestic and foreign, public and private investment sources will be involved, ranging from revenue-sharing initiatives and joint ventures to direct investment, transfer schemes, development fund established by a special tax on telecommunications, major private financial institutions, loans from international funding agencies and development banks, and incentive grants.

Joint investment and development involving users, governments, academic and financing institutions and agencies, technical cooperation agencies, and industry interests are seen as necessary. Partnerships with the informatics industry are fundamental and, in the case of general informatics tools, the industry practically drives the solutions. A concerted effort is needed to secure a clearly defined and specified partnership with the informatics industry at the global and national levels aimed at application development at acceptable cost. Investments must be attracted to the telecommunications industry by improving investment conditions, lower duties on telecommunications equipment, and pose no restriction on network design except for technical reasons to allow for new providers.

A retrospective of experiences shows that continuity and sustainability of information systems projects continue to be a major problem in developing countries. Externally funded projects frequently collapse upon funding termination and this fact demonstrates that all projects need justification in terms of cost-benefit and long-term financial sustainability besides organizational capacity to develop and implement information systems. This further indicates that spreading the financial risk across several stakeholders may be appropriate as cost sharing increases overall awareness, utilization, and long term potential for success.

4.6. Fostering International Cooperation

In the international setting, cooperation between developed and less developed countries is essential but special care must be taken to avoid interventionist behavior by donor or lending agencies that ignores the recipient's real needs and expectations, fails to understand capacities, demands action without allowing sufficient time for conceptual assimilation, neglects cultural constraints, and ignores the scope of the recipient's knowledge basis. As in many other areas of international cooperation the danger is to have too much too soon or too little too late.

A possible framework for collaborative work should include support to international health issues, healthcare reform implementation, application development, education, and economic and technological cooperation. Leading areas for technical cooperation include: priority assessment, technology evaluation and selection criteria, implementation issues, emerging technologies linking patients and providers, access to knowledge databases, consumer informatics, and the utilization of Internet and Internet-enabled technologies. International aspects of e-Health form a critical and urgent area still to be addressed by the World Trade Organization and regional trade blocks.

4.7. Bridging the Digital Divide

Only a more active role of government and public-private partnerships in supporting appropriate technology transfer and adaptation through indigenous research and development and the implementation of specific policies to protect local development will create an environment that will lead to a reduction of the present ICT development divide. Developing countries may take advantage of the accumulated knowledge and mistakes and may leapfrog developmental stages. However, this is not expected to be readily achieved due to the barriers posed by the general institutional underdevelopment, low income, illiteracy, and financial constraints that afflict many countries.

Governments and international development agencies and programs must urgently focus their work on the establishment of a telecommunications infrastructure that is comprehensive, reliable, ubiquitous, and compatible across applications – such an infrastructure must provide affordable bandwidth that is sufficient to serve the wide variety of users' specific needs. Its development will be dependent upon the continued deregulation of the telecommunications industry and will involve the leveraged use of many ICT technologies that have been spawned by and for other industries. Making information products and services available to the population in public spaces, libraries, schools, mobile computer units, and by subsidizing acquisition of equipment by students and professionals requires a level of investment that many countries cannot afford. By demonstrating that social projects, especially healthcare and education, can be advanced through improved information infrastructure, international technical cooperation and multilateral agencies must collaborate with national and international authorities and experts to demand that funding institutions finance projects in such areas. Consistent to these objectives, governments must demand that international and multilateral agencies must promote and support technical cooperation activities in the development of e-Health, primarily involving the transfer of knowledge, technical support, facilitation of the exchange of experiences between countries, and fostering the use of appropriate technology and knowledge assets.

Increasing the general population capacity to take advantage of information and communication technologies requires heavy investment in general education and capacitation in computer skills. A serious problem for non-English speaking countries is that most of the Internet is directed native speakers of English and most sites and exchanges are carried out in that language. Even physicians, who generally have a working knowledge of English, may have problems with such sites. This means that investment is required to develop applications, user interfaces, and contents in national languages.

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